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VARIABILITY OF ITALIAN RYEGRASS AND PERENNIAL RYEGRASS SEED QUALITY PRODUCED IN TWO DIFFERENT REGIONS

VARIJABILNOST KVALITETA SEMENA ITALIJANSKOG LJULJA I ENGLESKOG LJULJA PROIZVEDENIH U DVA REGIONA

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ABSTRACT

The paper presents the results of four seed lots produced in Serbia and Belarus in two years, and examines the influence of their quality on 1000 seed mass, germination energy and total germination. There was no impact of the region or the year on the studied seed quality parameters. There was high variability of 1000 seed mass (CV = 20.3 %) taken from different seed lots of Italian ryegrass. Lower variability was found for germination energy and total germination (CV = 9.88 % and CV = 7.98 %). Ryegrass seed lots had lower variability for 1000 seed mass (CV = 8.34 %), germination energy and total germination (CV = 4.80 % and CV = 3.70 %). In the seeds of both species there was no significant correlation dependence of seed mass regarding germination energy and total germination. Significant influence was determined in both species between germination energy and total germination (P≤0.001 and P≤0.05).

***Key words**: Italian ryegrass; perennial ryegrass; quality seeds.*

REZIME

Italijanski i engleski ljulj su značajne krmne i/ili ukrasne trave. U proizvodnji stočne hrane uglavnom se koriste u smeši sa leguminozama. Seme ovih vrsta se u Srbiji koristi delom iz proizvodnje u Srbiji, delom iz proizvodnje izvan Srbije (iz uvoza). Belorusija I Ukrajna se značajni proizvođači semena trava. Ma gde se proizvodnja semena odvijala kvalitet semena je od presudnog značaja za uspešno zasnivanje travnjaka i/ili travno-leguminoznih useva. U radu su prikazani rezultati ispitivanja po četiri partije semena proizvedenog u Srbiji I Belorusiji tokom dve godine I uticaj regiona proizvodnje na masu 1000 semena, energiju klijanja I klijavost. Nije utvrđen jasan zaključak o uticaju regiona proizvodnje (Srbija i Belorusija) I godine u kojoj se odvijala proizvodnja (2014 i2015) na ispitivane parameter kvaliteta. Između partija semena italijanskog ljulja je utvrđena visoka varijabilnost za masu 1000 semena (CV=20.3%), dok je za energiju klijanja I ukupnu klijavost utvrđena niža varijabilnost (CV=9.88% I CV=7.98%). Između partija semena engleskog ljulja je utvrđena niža varijabilnost za masu 1000 semena (CV=8.34%), kao I za energiju klijanja I ukupnu klijavost (CV=4.80% I CV=3.70%). Na semenima obe ispitivane vrste nije postojala značajna korelativna zavisnost mase semena sa energijom klijanja I ukupnom klijavošću. Takođe na obe vrste je utvrđena značajan (P≤0.001 i P≤0.05) pozitivna korelacija između energije klijanja i ukupne klijavosti.

***Ključnereči**: italijanski ljulj; engleski ljulj; kvalitet semena.*

INTRODUCTION

Italian ryegrass is grown over large areas in Europe, Asia, South America and Australia. It is characterized by high yield and quality fodder suitable for haymaking and for haylage and silage. This species is used only for forage and not as an ornamental plant. It has an important role as one of the components of grass-legume mixtures, and it is particularly suitable for combinations with red clover *(Simić, 2014)*. Perennial ryegrass is an important forage and ornamental plant, which is grown in Europe, North America, North Africa, Australia and Central Asia. It is considered to be one of the best grass species suitable for grazing of livestock. Varieties of perennial ryegrass are often used for decorative purposes (parks, playgrounds, yards...), as a pure crop or grass component with legumes in grass-legume mixtures. Good results are achieved in protecting land from erosion. In our conditions, the seeds of this species are mostly used for grass or grass legume mixtures for fodder and decorative purposes *(Vučković, 2004)*. Seeds used for establishing grasslands in Serbia are mainly imported, and in a smaller percent produced in Serbia from domestic cultivars. Ukraine and Belarus are very often the countries from which grass seeds offered on the Serbian market originate. The aim of this study was to determinate the variability of the seed lots quality of two species: Italian ryegrass (variety Aubade) and perennial ryegrass (variety Pašavi), which were produced in Serbia and Belarus in 2014 and 2015. The second objective was to determine the correlation dependencies between the parameters of seed quality: 1000 seed mass, germination energy and total germination.

MATERIAL AND METHOD

The studied seeds were taken from four seed lots of commercial production in Serbia and Belarus in 2014 and 2015: Italian ryegrass (*Lolium multiflorum* Lam. – Syn. L. italicum A. Br.) cultivar Aubade, and perennial ryegrass (*Lolium perenne* L.) cultivar Pašavi. The following parameters of seed quality were determined: mass of 1000 seeds (g); Energy of germination (%); Total germination (%). Analysis of seed quality was conducted in August and September 2014 (for seeds from 2014) and in August and September 2015 (for seeds from 2015). Four replications of every sample were done. Average samples were 60 g and working samples were 6 g. All analyses were conducted in accordance with the rules for seed quality testing *(ISTA rules, 2014; Pravilnik o kvalitetu semena poljoprivrednig bilja. Službeni list SFRJ 47/87)*. Statistical analyses: The mean value was calculated for all parameters. Measurements were performed on four replicates ± standard errors (S.E.). The results were analyzed by using analysis of variance (ANOVA). For

testing the difference between the mean treatment, Tukey's Multiple Range test and coefficient of variation (CV %) were applied. For interdependence between parameters, coefficients of simple correlation were calculated (r). Data of germination energy and total germination percentages were arcsin transformed [sqr (x/100)] before the analysis of variance. The program Minitab 16.1.0 was used for data processing.

RESULTS AND DISCUSSION

There are different results on the impact of a seed size on seed quality. According *Zareian et al. (2013*), the size of a wheat seed has no significant effect on germination. In contrast, *Kakhki et al. (2008)* show a much higher germination of seeds with larger mass. According to *Simic et al. (2010),* on the territory of Srem, mass of 1000 seeds of Italian ryegrass, depending on the growing technology, ranged from 3.15 to 5.12 g. This is slightly larger mass compared to our results (2.68 to 4.37 g), which indicates the importance of agricultural technology. The average mass of 1000 seeds of perennial ryegrass was 3.44 g. with variations from 3.00 to 3.90 (Tab. 3). Significantly lower variability for this feature was indicated by *Lakić et al., (2013).* This could probably be attributed to the genetics of the populations from the Republic of Serbia. Variability of 1000 seed mass depending on the seed lot in the two years and two regions ranged from CV = 23.9 % in Serbia in 2014 to CV = 12.1 % in Belarus in 2015. For the seed from Belarus in 2014 and the seed from Serbia in 2015 similar variability was established (CV = 15.2 % and CV = 17.6 %).Seed quality of grasses for forage and decorative purposes is influenced by growing technologies and genetics *(Simić et al., 2010; Veliijević et al., 2016).* Significant impact on the quality of seeds is made by a post-harvest treatment and a method of seed storage *(Stanisavljević et al. 2012, 2014, 2016).* Forage grasses and ornamental grasses are mainly grown in mixtures with legumes. Therefore, high germination and initial growth of seedlings is crucial for the projected ratio of the mixture (grass-legume) *(Lakic, 2012).* Many authors have studied the relationship between 1000 seed mass, seed germination and initial growth of seedlings on forage grasses. For example, *Bean (1973)* reported that 1000 seed mass is significantly positively correlated with the initial increase in ryegrass seedlings. Similar results were obtained for Italian ryegrass *(Hampton, 1986),* cocksfoot and cat tail *(Evans, 1973).* In our study, for the seeds of Italian ryegrass there is no significant correlation between the mass of 1000 seeds and germination (r = -0.041), or the seed mass and total germination (r = -0,038). Lower variability was found for germination (CV = 12.2 % – Serbia in 2014, CV = 12.1 % – Belarus 2015, and CV = 24.9 % – Serbia 2015). The lowest variability of the investigated traits was determined for total germination (CV = 10.8% – Belarus 2015 to CV = 7.79 % – Serbia 2015), (Tab. 1). As expected, highly significant positive correlation between the germination energy and total germination was found (r = 0.923), (Tab.2). Unlike Italian ryegrass, for the ryegrass seed lower variability for all parameters was determined (1000 seed mass = 9.46.2 % – Belarus 2014 to CV = 7.51 % – Serbia 2015; germination energy: CV = 6.00 % – Belarus 2014 to CV = 26.2 % – Serbia 2015; total germination: CV = 5.09 % – Belarus 2014 to CV = 2.43 % – Serbia 2014), (Tab. 3). Also, the overall variability of the studied traits (seed mass, germination energy and total germination) in two places of seed production (Serbia, Belarus) and two years (2014 and 2015) for perennial ryegrass was lower (CV = 8.34 % for seed mass; CV = 4.80 for germination energy; CV = 3.55 for total germination) than for Italian ryegrass (CV = 20.3 % for mass of seeds; CV = 9.88 for germination energy; CV = 7.98 for total germination), (Tab. 1, Tab. 3).

Table 3. Variability of the seed quality of perennial ryegrass in two production years

Origin / year production seed	Variety / lot / year of seed analysis	1000 seed mass, g (S.E.)	Germination energy, % (S.E.)	Total germination, % (S.E.)
Serbia 2014	Pašavi/1/2014	3.667 ± 0.020 ^{A}	75 ± 0.504^{AB}	87 ± 0.699^{A}
	Pašavi /2/2014	3.859 ± 0.021 ^{A}	73 ± 0.511 ^{B}	84 ± 0.699^{AB}
	Pašavi /3/2014	3.315 ± 0.017 ^{AB}	74 ± 0.593 ^{B}	77 ± 0.699^{B}
	Pašavi /4/2014	3.227 ± 0.018 ^{AB}	80 ± 0.503 ^{A}	82 ± 0.699 ^{AB}
	$\overline{X}$	3.517	76	83
	CV (%)	8.44	4.12	5.09
Belarus 2014	Pašavi /1/2014	3.763 ± 0.016 ^{A}	85 ± 0.494^{A}	91 ± 0.699^{A}
	Pašavi /2/2014	3.339 ± 0.020 ^{AB}	82 ± 0.564^{A}	87 ± 0.699^{A}
	Pašavi /3/2014	3.004 ± 0.019 ^{B}	78 ± 0.564^{AB}	83 ± 0.699 ^{AB}
	Pašavi /4/2014	3.253 ± 0.017 ^{AB}	74 ± 0.564^{B}	83 ± 0.699 ^{AB}
	$\overline{X}$	3.340	80	85
	CV (%)	9.46	6.00	2.43
Serbia 2015	Pašavi /1/2015	3.731 ± 0.018 ^{AB}	77 ± 0.564^{AB}	85 ± 0.699^{AB}
	Pašavi /2/2015	3.901 ± 0.020 ^{A}	74 ± 0.564^{B}	86 ± 0.699^{AB}
	Pašavi /3/2015	3.299 ± 0.017 ^{AB}	77 ± 0.564^{AB}	77 ± 0.699^{B}
	Pašavi /4/2015	3.456 ± 0.018 ^{AB}	78 ± 0.564^{AB}	83 ± 0.699^{AB}
	$\overline{X}$	3.597	77	83
	CV (%)	7.51	2.26	4.87
Belarus 2015	Pašavi /1/2015	3.699 ± 0.019 ^{A}	80 ± 0.564^{AB}	88 ± 0.699^{A}
	Pašavi /2/2015	3.102 ± 0.020 ^{B}	80 ± 0.564^{AB}	86 ± 0.699^{AB}
	Pašavi /3/2015	3.125 ± 0.016 ^{B}	75 ± 0.564^{AB}	82 ± 0.699^{AB}
	Pašavi /4/2015	3.331 ± 0.015 ^{AB}	71 ± 0.564^{B}	82 ± 0.699^{AB}
	$\overline{X}$	3.314	77	85
	CV (%)	8.34	5.70	3.55
For total	F test	*	**	**
	average	3.442	77	83
	min.	3.004	71	77
	max.	3.901	85	87
	CV (%)	8.34	4.80	3.70

$^{A, B}$*…significant effect (P≤0.05; Tukey's Multiple Range test) for the column*

Table 2. Coefficients of simple correlation (r) between the studied characteristics of Italian ryegrass seeds

Feature	Germination energy, %	Total germination, %
1000 seed mass, g.	-0.041 NS	-0.038 NS
Germination energy, %	-	0.923 ***
Total germination, %		-

*Statistical significance level: *P≤ 0.05; **P≤0.01; ***P≤0.001; NS not significant*

Table 4. Coefficients of simple correlation (r) between the studied traits of perennial ryegrass seeds

Feature	Germination energy, %	Total germination, %
1000 seed mass, g.	-0. 032 NS	-0.017 NS
Germination energy, %	-	0.578 *
Total germination, %		-

*Statistical significance level: *P≤ 0.05;**P≤0.01; ***P≤0.001;NS not significant*

No significance was determined in the seeds of perennial ryegrass in the correlation between seed mass and seed germination (r = -0.032), or between seed mass and total germination (r = -0.017). Positive and significant correlation was found for the correlation between germination energy and total germination (r = 0.578), (Tab. 4).

CONCLUSION

Seed lot had a very strong impact on 1000 seed mass of Italian ryegrass during the study period, regardless of the region. The studied seed lots of perennial ryegrass showed lower variability for this trait. There was no correlation between the impact of the production site (Serbia, Belarus), the year of production (2014, 2015) and the characteristics of seed quality. There was no significant correlation relationship between Italian ryegrass seed mass and germination energy or seed mass and total germination. Highly significant correlation was found between germination energy and total germination (r = -0,923).

For perennial ryegrass seed samples, there was no significant correlation relationship between the seed mass and germination energy, or the seed mass and total germination. Very significant correlation was established between germination energy and total germination (r = -0,923).

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